

## PROPOSAL ARC-0518226 'PLANNING ACTIVITIES FOR THE BERING ECOSYSTEM STUDY'

**(1) Please review and, as appropriate, revise the information you have reported as your major research and education activities:**

BEST planning activities have been ongoing since 2002. Previous planning efforts, initiated under NSF proposal ARC-0226371 'Workshop to Assess Research Priorities in the Bering Sea', focused on the formulation of the BEST Science Plan. Starting in March 2005, NSF proposal ARC-0518226 'Planning Activities for the Bering Ecosystem Study (BEST)' has supported ongoing planning efforts, including the establishment of the BEST Planning Office (BEST PO) housed at the University of Washington in Seattle (UW).

The performance period of this third year report spans **April 1 2007 - March 31 2008**, and this report was compiled 90 days before the end of the period (January 1, 2008).

**A) BEST Implementation:**

We continued working towards effective implementation of BEST by (a) helping to integrate the currently-funded projects into a larger and cohesive research program, and (b) by leading the public outreach and educational activities for the BEST program.

(a) The BEST PO, in collaboration with the Ecosystem Studies of Sub-Arctic Seas (ESSAS) program, organized a special session on 'Climate impacts on sub-polar seas: mechanisms of change and evidence of response' at the March 2008 ASLO - AGU Ocean Sciences Meeting in Orlando, Florida. Ten papers in all were accepted for oral presentations: 4 from the 2007 BEST cruise, 4 from the North Atlantic, one on the Antarctic, and one comparing the Bering Sea with other sub-arctic seas. In addition, several posters were accepted for presentation. The PO is currently developing a venue and format for an evening workshop at this conference, to discuss approaches to synthesize and compare studies of the impact of climate on the sub-arctic seas.

(b) The BEST PO outreach activities focused on sharing information about the funding opportunities under the joint NSF and NPRB RFP, about the research programs involved in the BEST program, and about BEST field activities in 2007. To this end, BEST PO representatives gave presentations on the progress of the program at scientific meetings and reported to the various organizations involved in Bering Sea and Arctic research, including SEARCH, NPRB, and PICES.

The BEST PO also led outreach efforts to disseminate the results of the first BEST cruise in April – May 2007. As part of the BEST PolarTrec expedition (April 7 - May 14, 2007), two teachers, Maggie Prevenas and Robyn Staup posted daily diary entries on the web and broadcasted three web-based seminars using powerpoint presentations and satellite phones to answer questions from school children and their teachers across the United States.



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The BEST PO also participated in several presentations to advertise and complement these web-based outreach activities in the last year:

- March 8 - 11, 2007: BEST participated in the Polar Weekend activities at Seattle's Science Center, by showcasing a poster on the upcoming BEST cruise, alongside the U.S. Coast Guard exhibit on the ice-breaker Healy ([www.psc.apl.washington.edu/psw/](http://www.psc.apl.washington.edu/psw/))
- April 27, 2007: Visit and presentation to the St. George school, Pribilof Islands.
- April 28, 2007: Visit and presentation to the St. Paul school, Pribilof Islands.

**B) Inter-agency Collaboration:**

To ensure that the available resources are used in the most effective way possible, the BEST PO has worked with national and international research and funding organizations to coordinate BEST activities with other research programs working in the Bering Sea, the North Pacific, and other sub-arctic seas. These collaborative efforts have addressed three areas: (a) synergistic activities of BEST within the framework of SEARCH, (b) domestic and international research and funding organizations working in the Bering Sea, and (c) contributions of BEST to the international ESSAS program.

(a) To ensure BEST maintains a connection with the SEARCH (Study of Environmental Arctic Change) program, Dr. Hunt participated in one SEARCH SSC meeting during 2007, held in Washington (D.C.). At this meeting, Dr. Hunt suggested ways for enhancing synergisms between BEST and SEARCH.

(b) Inter-agency activities with domestic partners have included the following agencies and organizations: the North Pacific Research Board (NPRB), the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Fish and Wildlife Service (USFWS). The BEST PO participated in the first BEST cruise (April – May 2007), where Dr. Hyrenbach worked closely with BEST researchers (Drs. David Shull and Ray Sambrotto), NOAA scientists (Drs. Peggy Sullivan and Ned Cokelet) and PolarTrec teachers (Robyn Staup and Maggie Prevenas) to organize the outreach activities at the Pribilof Islands and the posting of the web-based cruise log and expedition reports.

The BEST PO has also worked to reinforce its links with international research programs. BEST is the major U.S. contribution to the ESSAS program, and has been given observer status by the North Pacific Marine Science Organization (PICES). Thus, developing programmatic synergies with these research programs has been a major priority of the BEST PO during 2007.

Drs. Hunt and Hyrenbach represented BEST at the annual PICES meeting held in Victoria (British Columbia), where they presented a poster showcasing the new projects funded by the second BEST announcement of opportunity and the results of the first BEST cruise. During the PICES meeting, presentations were made to the Biological

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Oceanography Committee, the Physical Oceanography Committee, and the CFAME (Climate Forcing and Marine Ecosystems) task team. Drs. Hunt and Hyrenbach also had numerous opportunities to answer questions about BEST and BSIERP from the community of scientists attending PICES. The PICES meeting also provided Dr. Hunt with the opportunity to hold discussions with Dr. Ken Drinkwater, Co-Chair of ESSAS, about future BEST contributions to ESSAS.

c) The GLOBEC regional program, Ecosystem Studies of Sub-arctic Seas (ESSAS) held a series of workshops in Norway and Japan. BEST participated in both meetings as the U.S. contribution to ESSAS.

In March 2007, Dr. Hunt was invited to participate in a MENU (Marine Ecosystem of Norway and the US) Workshop in Bergen, Norway. MENU is a collaborative program between US and Norwegian marine scientists within ESSAS. The goals of MENU are to develop intercomparisons of sub-arctic marine ecosystems to facilitate transfer of information valuable to managing these systems in a time of rapid climate change. There is potentially an important role of BEST and BSIERP scientists in MENU, as the Bering Sea is a place where climate variability is eliciting a strong response from the ecosystem.

BEST was also invited to send representatives to the ESSAS workshops held from 4 to 8 June 2007 in Hakodate (Japan) dealing with 'The role of seasonal sea ice cover in marine ecosystems' and 'Evaluation of Future ESSAS Climate Scenarios'. BEST P.I. Jinlun Zhang attended the sea ice workshop and BEST SSC chair and PO lead Dr. George Hunt attended the entire meeting, as did BEST SSC member, Dr. Kenneth Rose. Participation in these workshops allowed BEST to establish critical links with other researchers involved in sea-ice and ecosystem modeling studies in other ESSAS regions, and thus advanced discussions on modeling ecosystem responses to climate change in different sub-arctic regions. Establishing these working relationships early on will be critical to facilitate the integration of BEST with ESSAS research in other regions of the sub-arctic. During the ESSAS SSC meeting, Dr. Hunt reported on the progress made in BEST, including the results of the first BEST solicitation and that there was underway consideration of both the NPRB and NSF solicitations for work beginning in 2008.

**(2) Please review and, as appropriate, revise the information you have reported on outreach activities.**

During the last nine months (April 1, 2007 – December 31, 2007), the BEST PO has engaged in outreach activities through three main avenues: (A) presenting BEST goals and priorities to the broader scientific community at meetings and public lectures, (B) continuing to develop a publicly-available BEST web-site, and (C) establishing partnerships for developing outreach and educational products.

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**A) Presentations:** The BEST PO gave four presentations at scientific meetings and public outreach events.

**- Oral Presentations at Scientific Meetings:**

Hyrenbach, K.D., Hunt, G.L. 2007. The Bering Sea Ecosystem Study. NW Tribal Water Rights Conference, Shelton, WA, October 24 – 25, 2007 (Oral Presentation).

**- Poster Presentations at Scientific Meetings:**

Hunt, G.L., Hyrenbach, K.D. 2007. The Bering Sea Ecosystem Study: Progress Report. North Pacific Marine Science Organization (PICES) 16<sup>th</sup> Annual Conference, Victoria, BC, October 26 - November 5, 2007 (Poster Presentation).

**- Public Lectures:**

Hyrenbach, K.D. 2007. Upper-trophic Predators as Integrators of Large-scale Variability in Marine Ecosystems: Oceanographic and Conservation Implications. Hawaii Pacific University. 15 May, 2007. (Invited Seminar).

Dr. Hunt presented posters, photo albums and other material on BEST and ESSAS at the School of Aquatic and Fishery Sciences pavilion during Washington Week, April 2007.

**B) BEST Project Web-sites:** We continued maintaining a publicly-available web-site, including background and outreach information on the BEST project and the marine ecosystems of the Bering Sea, housed at the University of Washington's School of Aquatic and Fishery Sciences (SAFS): <http://fish.washington.edu/best>. The launching of the integrated Bering Integrated Ecosystem Research Program (BSIERP) in September 2007, signified the transition of BEST from the planning to the implementation phase. The BEST Planning Office transferred all of the relevant web-site materials to the newly created BEST – BSIERP Project Office, under the auspices of the North Pacific Research Board (NPRB). NPRB will maintain the site for the duration of the project (2007 – 2012)

**C) Outreach Activities:** As the clearing-house for BEST project information and outreach materials, the BEST PO collaborated with partners in the social and the natural science components of BEST to develop outreach materials for the public at large.

To this end, the BEST PO participated in the first BEST cruise in April – May 2007. To facilitate outreach activities during the cruise, Dr. Hyrenbach worked with the two PolarTrec teachers, with NOAA scientists, and with the Coastguard to coordinate three outreach activities:

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a) Web-based materials: Working with NOAA and PolarTrec, we developed a 'virtual expedition' devoted to highlighting the first BEST cruise. We posted a variety of outreach and educational materials on two web-sites created to support the BEST cruise and hosted by NOAA ([www.pmel.noaa.gov/foci/ice07/](http://www.pmel.noaa.gov/foci/ice07/)) and the NSF-supported PolarTrec program ([www.polartrec.com/bering-ecosystem-study](http://www.polartrec.com/bering-ecosystem-study)). The highlights of these web-based materials include a cruise log-book compiled by Dr. David Hyrenbach, a photo gallery featuring over 600 images of the cruise activities and the landscapes and wildlife of the Bering Sea, and the diaries of the PolarTrec teachers onboard the USCGC Healy.

b) School visits by scientists: We organized two visits by BEST and NOAA scientists to local schools in the Pribilof Islands, during a stop-over of the 2007 BEST cruise.

On April 27, a group including NOAA and BEST researchers, the two PolarTrec teachers and representatives of the BEST PO and Coastguard disembarked the USCGC Healy and ventured to St. George via inflatable boat for a day of activities at the local school. After lunch, Ray Sambrotto (cruise chief scientist), David Hyrenbach (BEST PO) and Ned Cokelet (from NOAA's Pacific Marine Environmental Lab) gave a presentation - open to the community - about the Bering Ecosystem Study and the objectives and results of this cruise. After a lively question and answer session, the crew head back to the vessel.

On April 28, a group of incoming NOAA scientists, lead by Dr. Carol Ladd, gave a presentation at the St. Paul school before meeting the USCGC Healy. The two teachers onboard the ship (Maggie Prevenas and Robyn Staup) were dropped off via helicopter in the early morning for a day of activities with local teachers and students at St. Paul.

c) Ship visits by people from the local communities: During the vessel stops at the Pribilof Islands, we also had an opportunity to embark several students and teachers from both islands for a tour of the vessel and the science spaces. Seven people from St. George (four students, two teachers, and a community representative) came onboard on the evening of April 27. A day later, three people from St. Paul (a high school student equipped with voice recording equipment, a teacher and a community leader) came onboard on the evening of April 28. The discussions and interviews recorded during the cruise visit were then shared with other high-school students from St. Paul.

### (3) Publications and Products:

- Grey Literature:

George L. Hunt, Jr., Egil Sakshaug, James E. Overland, and Bernard A. Megrey. (2007) ESSAS meets in Hakodate, Japan. PICES Press, 15(2) (July 2007). pp. 14-17.

Jeffrey M. Napp. (2007) The Bering Sea: Current status and recent events. PICES Press, 15(2) (July 2007). pp. 24-25

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- Internet Dissemination:

We continued populating the BEST web-site that we developed at the beginning of this project ([www.fish.washington/best](http://www.fish.washington/best)), which is housed at the University of Washington's School of Aquatic and Fishery Sciences (SAFS). This web-site, which includes background and outreach information on BEST and the marine ecosystems of the Bering Sea, became publicly available on September 18, 2006. We have monitored the activity at the web-site automatically, by compiling information on the number and nature of visits to the site. As of January 1, 2008 these are the cumulative statistics:

**2400 Page Loads** - The number of times the site has been visited.

**1186 Unique Visitors** – Based purely on a cookie. This is the total of the returning visitors and first time visitors - all the visitors to the site.

**816 First Time Visitors** - Based purely on a cookie. If a visitor does not have a cookie from a previous visit, this is considered the first time they visit the site.

**370 Returning Visitors** - Based purely on a cookie. If a visitor returns to the site, at least an hour or more after a previous visit.

The average monthly traffic into the web-site more than doubled in 2007, with 172 page loads and 89 unique visitors per month (January – December), compared with 83 page loads and 31 unique visitors per month in 2006 (September – December).

Year	Page Loads	Unique Visitors	First Time Visitors	Returning Visitors
2007	2,068	1,062	733	329
2006	332	124	83	41

We also monitored some geographic and keyword information from web-site visitors:

Origin of unique visitors to the BEST web-site (percentages of 100%): List of the four leading nations based on I.P. addresses

- 89.00 % United States
- 4.00 % Canada
- 3.00 % China
- 3.00 % Japan

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Keywords used by visitors to the BEST web-site (percentages of 100%)

29.4 % “best home page”  
11.7 % “bering sea best”  
11.7 % “nsf best”  
11.7 % “best bering sea program”  
5.9 % “best planning”  
5.9 % “best”  
5.9 % “nsf best program”  
5.9 % “best nsf”  
5.9 % “best office”

**(4) How have your findings, techniques you developed or extended, or other products from your project contributed to the principal disciplinary field(s) of the project?**

The dissemination of information on the BEST program, the BEST cruise, and climate change in the Bering Sea through three web-sites, scientific meetings (PICES, ESSAS) and public presentations have raised the interest of the scientific community in the changes taking place in the Bering Sea ecosystem, and have helped to publicize the ongoing and future research efforts of BEST. Because these online resources have been linked to the developing BEST – BSIERP Project Office, they will be available to researchers and the public throughout the duration of the BEST program (2007 – 2021)